Janet Napolitano, Governor
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April 22, 2005

Arizona DEQ – Development of Chronic Ambient Air Concentrations (Long-Term)

1. INTRODUCTION

Of the total 188 Federal Hazardous Air Pollutants (HAPs) identified by EPA, approximately 75 are emitted by Arizona industries in sufficient quantities to potentially require evaluation. Part of this evaluation is to develop health-based criteria that represent chronic ambient air concentrations. Health Based chronic ambient air criteria will be developed for individuals (including sensitive populations) to establish exposure levels to protect against serious health affects. The approach used to develop chronic ambient air concentrations is described below based on a hierarchy of applicable health-based criteria.

In the development of this hierarchy of health-based criteria, a preference was placed on national EPA toxicity criteria, namely Reference Concentrations (RfCs) and air Unit Risk Factors (URFs) as presented in the Integrated Risk Information System (IRIS). While there are numerous state air toxic programs, as well as international programs, EPA health-based criteria were given the highest priority (Tier 1). EPA criteria are peer-reviewed and have been used in a similar fashion throughout the United States. Many of the state and regional air toxic programs rely on the values in IRIS as a basis for their criteria. In addition, the National Ambient Air Quality Standard (NAAQS) was used for lead.

After national EPA criteria, the second tier included criteria developed in various EPA regions. For example, EPA Region 9, which includes Arizona, provides Preliminary Remediation Goals (PRGs). PRGs are conservative health-based concentrations that are estimated using both criteria presented in IRIS and other toxicity criteria when IRIS values were not available. EPA Region 3 Risk-Based Concentrations (RBCs), which are derived using similar assumptions as the PRGs, were also considered. These region-specific criteria are sometimes not as extensively peer-reviewed as IRIS values, but they represent the next best option for establishing long-term ambient air criteria.

The third tier includes the Agency for Toxic Substances and Disease Registry (ATSDR) Minimal Risk Levels (MRLs) and the California EPA (CalEPA) Reference Exposure Levels (RELs) and Unit Risk Factors. These are valuable resources that can be used to fill in gaps and, in some cases, to provide the most recent, applicable source of toxicological information.

When no criteria were available from any of the above-mentioned references (Tier 4), which only occurs in a few instances, other approaches were considered. For example, if a listed compound represents a group of compounds, a surrogate compound within that

group was identified and the process described above was completed for that individual compound.

2. CRITERIA DEVELOPMENT PROCESS

The process used to identify the most appropriate ambient air criteria for the compounds emitted by Arizona industries is presented in the following sections. Figure 1 shows the process as a flow chart.

Tier 1 – National, Peer-Reviewed EPA Criteria

- **Reference Concentrations (RfCs) from IRIS**
- **Unit Risk Factors (URFs) from IRIS**
- **National Ambient Air Quality Standards (NAAQS)**

The values from these criteria were preferentially used over all others. If a pollutant had an established RfC or URF in IRIS, this value was used after an adjustment for an exposure duration of 350 days per year for 30 years was applied. These are the same assumptions used in the development of the PRGs and RBCs, and are more appropriate for the use intended. This results in slightly less conservative criteria than the RfCs and URFs as published in IRIS. For lead, the NAAQS was used.

In addition, other criteria (i.e., PRGs, RBCs, MRLs, and CalEPA values) were reviewed to determine whether the IRIS values are in reasonable agreement. If there was agreement, the RfC or the URF was selected. This occurred for the majority of the compounds evaluated. If there was not agreement, further evaluation was performed to understand the rationale for the variation. If it was determined that one of the other criteria was developed based on a more recent and/or relevant study, the more applicable value was substituted for the RfC or the URF. This is clearly noted in the footnotes in Table 1.

In cases where both an RfC and a URF was available, the more stringent of the two was selected.

Tier 2 – Regional U.S. EPA Criteria

- **EPA Region 9 Ambient Air PRGs**
- **EPA Region 3 Ambient Air RBCs**

In cases where RfCs or URFs were not available in IRIS, two EPA regional sources were reviewed: ambient air PRGs and RBCs. PRGs and RBCs are developed in their respective EPA region based on a variety of sources including IRIS, the National Center for Environmental Assessment (NCEA), EPA's Provisional Peer Reviewed Toxicity Values, and California EPA, among others. These levels are based on a residential setting

where an individual could be exposed to ambient air concentrations for 350 days per year for 30 years. In cases where a PRG and an RBC was available, they were compared to ensure reasonable agreement. If the values were similar, as was often the case because of the similarity in the process used to develop these criteria, the PRG was selected simply because PRGs are developed by EPA Region 9 and Arizona is in this EPA region.

In addition to the comparison between the PRG and RBC, other available criteria (MRLs and CalEPA values) were reviewed to determine whether the values were in reasonable agreement. If they were in reasonable agreement, then the PRG was selected. If they were not, further evaluation was performed to understand the rationale for the variation. If it was determined that one of the other criteria was developed based on a more recent and/or relevant study, the more applicable value was substituted for the PRG/RBC.

Tier 3 – Other Applicable Criteria

- **ATSDR Minimal Risk Levels (MRLs)**
- **California EPA Reference Exposure Levels (RELs)**
- **California EPA Unit Risk Factors (URFs)**

In cases where Tier 1 or Tier 2 values were not available, ATSDR MRLs and CalEPA values were reviewed. Like the Tier 1 criteria, these values were adjusted for an exposure duration of 350 days per year for 30 years. These are the same assumptions used in the development of the PRGs and RBCs, and are more appropriate for the use intended. The available criteria were evaluated and the most appropriate selected.

Tier 4 – No Health-Based Ambient Air Criteria Available

There are several reasons why a certain compound would have no criteria available. In some cases, the identified compound is really a group of compounds. Glycol ethers and Polycyclic Organic Matter are examples of this. In these cases, a surrogate compound from the group of compounds was selected (if possible) and the group of compounds was evaluated as the single compound. Since the evaluation represents a screening approach, the compound in the group with the most stringent toxicological criteria was selected.

Another reason for the lack of toxicological criteria is that there is not enough data to develop such a criterion. In these cases, a surrogate compound was recommended based on what can be identified about the structure of the compound. In a couple cases, there was no obvious surrogate and more in-depth evaluation may be necessary.

It should also be noted that some compounds are in the process of having their toxicological criteria modified. This is not unusual, and in fact, toxicological criteria are often re-evaluated and updated. These situations are noted along with an explanation of the likely impact of the change, if known. If available, the expected time frame of the change is also presented.

Table 1 presents the initial development of chronic ambient air criteria. The table shows each of the available criteria, the applicable Tier used in the selection process, and specific information on the selection on the separate footnotes page. The compounds are listed in order of the amount of compound emitted from Arizona industries from the Arizona DEQ and TRI databases transmitted to Weston Solutions, Inc.

Lead is a HAP but is not included in this evaluation because it already is covered under other federal programs and the Arizona State Implementation Plan. EPA set identical health-protection (primary) and welfare-protection (secondary) national ambient air quality standards for lead in 1978. There are no non-attainment areas for lead in Arizona. In addition, current Arizona rules set the PSD major source threshold for lead at 5 tpy, and significant emissions increases at 0.6 tpy (See AAC R18-2-401(9)(e) and 101.105(a), respectively). New and modified area sources of lead are therefore already subject to new source review requirements, including the imposition of Best Available Control Technology and ambient air quality analyses. These requirements are more stringent than those that would apply to new and modified area sources under the state HAPs program.

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Definition of Key Terms Used to Derive Chronic Ambient Air Criteria

U.S. EPA

Reference Concentration (RfC) – An estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. It can be derived from a NOAEL, LOAEL, or benchmark concentration, with uncertainty factors generally applied to reflect limitations of the data used. Generally used in EPA's noncancer health assessments. (http://www.epa.gov/iris/)

Unit Risk Factor (URF) – The upper-bound excess lifetime cancer risk estimated to result from continuous exposure to an agent at a concentration of 1 $\mu g/m^3$ in air. The interpretation of unit risk would be as follows: if unit risk = 1.5×10^{-6} $\mu g/m^3$, 1.5 excess tumors are expected to develop per 1,000,000 people if exposed daily for a lifetime to 1 µg of the chemical in 1 cubic meter of air. (http://www.epa.gov/iris/)

Preliminary Remediation Goals (PRGs) – Risk-based concentrations developed by EPA Region 9 and calculated using a target risk of one-in-a-million (1E-06) for cancer effects and a target hazard quotient of one for noncancer effects. They combine current human health toxicity values with standard exposure factors to estimate contaminant concentrations in environmental media, in this case ambient air, that are considered by the Agency to be health protective of human exposures (including sensitive groups), over a lifetime. Ambient air PRGs are calculated assuming residential exposure (i.e., child and adult exposure for 350 days/years for a duration of 30 years. (http://www.epa.gov/region09/waste/sfund/prg/index.htm)

Risk-Based Concentrations (RBCs) – Similar to the PRGs, the RBCs are developed by EPA Region 3 and calculated using a target risk of one-in-a-million (1E-06) for cancer effects and a target hazard quotient of one for noncancer effects. They combine current human health toxicity values with standard exposure factors to estimate contaminant concentrations in environmental media, in this case ambient air, that are considered by the Agency to be health protective of human exposures (including sensitive groups), over a lifetime. Ambient air RBCs are calculated assuming residential exposure (i.e., child and adult exposure for 350 days/years for a duration of 30 years. The parameters used to derive RBCs are slightly different than those used to derive PRGs; therefore, there is a slight difference between the two.
(http://www.epa.gov/region09/waste/sfund/prg/index.htm)

ATSDR

Minimal Risk Level (MRL) – Like EPA's RfC, an MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure. These substance specific estimates, which are intended to serve as screening levels, are used by ATSDR health assessors and other responders to identify contaminants and potential health effects that may be of concern at hazardous waste sites. MRLs are based on noncancer health effects only and are not based on a consideration of cancer effects. ATSDR uses the no observed adverse effect level/uncertainty factor (NOAEL/UF) approach to derive MRLs for hazardous substances. They are set below levels that, based on current information, might cause adverse health effects in the people most sensitive to such substance induced effects. (http://www.atsdr.cdc.gov/mrls.html)

CalEPA

Reference Exposure Level (REL) – Chronic reference exposure levels are concentrations below which adverse health effects are not likely to occur. A central assumption is that a population threshold exists below which adverse effects will not occur in a population; however, such a threshold is not observable and can only be estimated. Areas of uncertainty in estimating effects among a diverse human population exposed continuously over a lifetime are addressed using extrapolation and uncertainty factors. (http://www.oehha.ca.gov/air/chronic_rels/AllChrels.html)

Unit Risk Factor (URF) – Like EPA's URF, the CalEPA URF represents the upper-bound excess lifetime cancer risk estimated to result from continuous exposure to an agent at a concentration of 1 $\mu g/m^3$ in air. The interpretation of unit risk would be as follows: if unit risk = 1.5×10^{-6} $\mu g/m^3$, 1.5 excess tumors are expected to develop per 1,000,000 people if exposed daily for a lifetime to 1 µg of the chemical in 1 cubic meter of air. (http://www.oehha.ca.gov/air/cancer_guide/index.html)

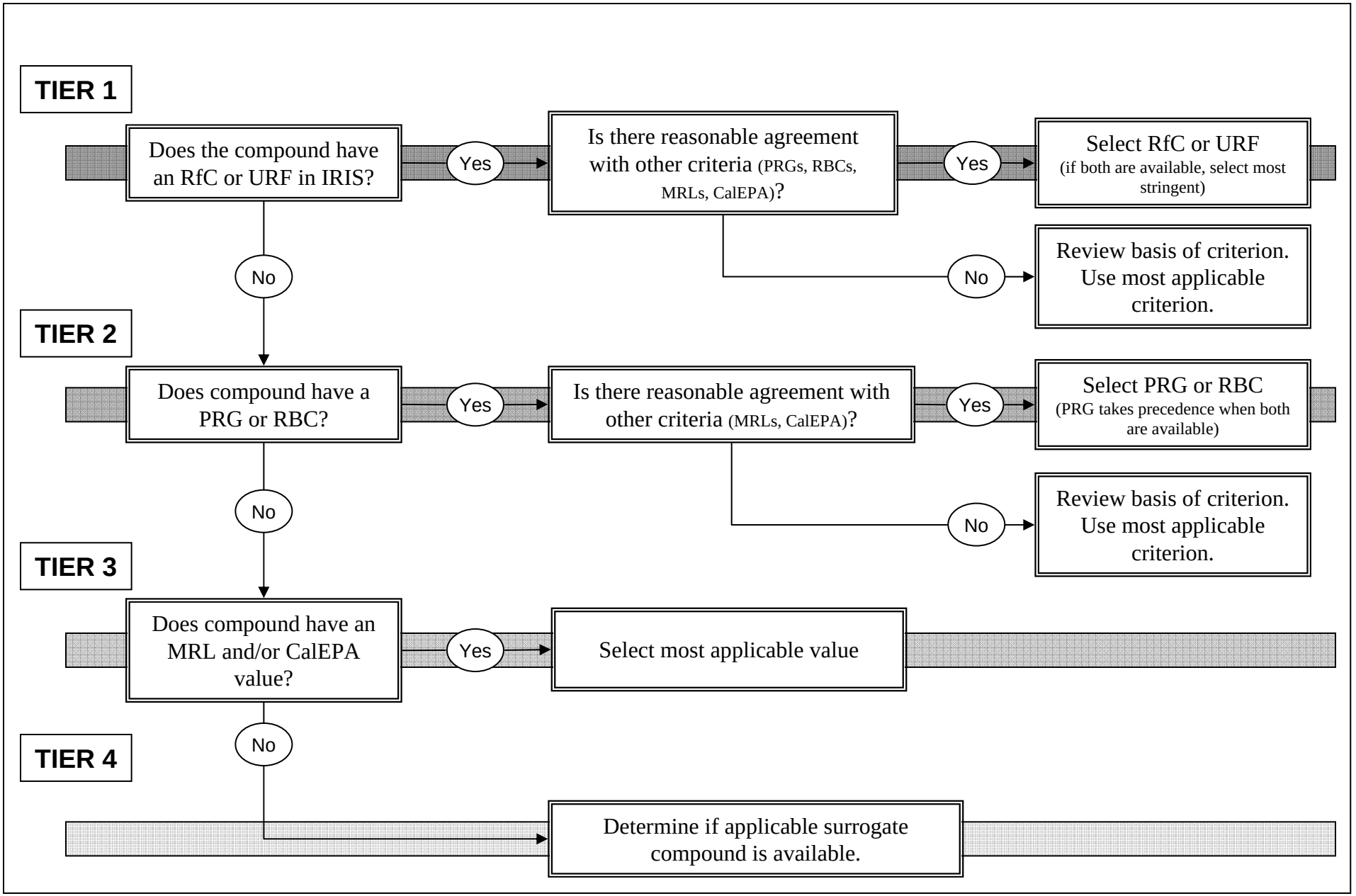

FIGURE 1 – Flowchart for the Selection of the Chronic Ambient Air Concentrations

May 11, 2005

Table 1 - Arizona DEQ - Chronic Ambient Air Concentrations Table

Chemical	Tier 1 EPA RfC (mg/m^3)	Tier 1 EPA RfC Adjusted Health-Based Concentration[a] (mg/m^3)	Tier 1 EPA URF ($mg/m^3)^{-1}$)	Tier 1 EPA URF Adjusted Health-Based Concentration[b] (mg/m^3)	Tier 2 EPA Regions Ambient Air PRG (mg/m^3)	Tier 2 EPA Regions Ambient Air RBC (mg/m^3)	Tier 3 ATSDR MRL (mg/m^3)	Tier 3 ATSDR MRL Adjusted Health-Based Concentration[a] (mg/m^3)	Tier 3 CalEPA REL (mg/m^3)	Tier 3 CalEPA REL Adjusted Health-Based Concentration[a] (mg/m^3)	Tier 3 CalEPA URF ($mg/m^3)^{-1}$)	Tier 3 CalEPA URF Adjusted Health-Based Concentration[b] (mg/m^3)	Value to be Used	Notes
Acetaldehyde	9.00E-03	9.39E-03	2.20E-03	8.62E-04	8.73E-04 C	8.13E-04 C			9.00E-03	9.39E-03	2.70E-03	7.02E-04	URF/Tier 1	
Acetophenone						3.65E-01 N							RBC/Tier 2	c
Acrolein	2.00E-05	2.09E-05			2.09E-05 N	2.08E-05 N			6.00E-05	6.26E-05			RfC/Tier 1	
Acrylonitrile	2.00E-03	2.09E-03	6.80E-02	2.79E-05	2.83E-05 C	2.61E-05 C			5.00E-03	5.21E-03	2.90E-01	6.54E-06	URF/Tier 1	
Antimony Compounds						1.46E-03 N							RBC/Tier 2	d
Arsenic Compounds			4.30E+00	4.41E-07	4.47E-07 C	4.15E-07 C			3.00E-05	3.13E-05	3.30E+00	5.75E-07	URF/Tier 1	
Benzene	3.00E-02	3.13E-02	7.80E-03	2.43E-04	2.49E-04 C	2.32E-04 C			6.00E-02	6.26E-02	2.90E-02	6.54E-05	URF/Tier 1	
Benzyl Chloride					3.96E-05 C	3.68E-05 C			1.20E-02	1.25E-02	4.90E-02	3.87E-05	PRG/Tier 2	e
Beryllium Compounds	2.00E-05	2.09E-05	2.40E+00	7.90E-07	8.00E-07 C	7.45E-07 C			7.00E-06	7.30E-06	2.40E+00	7.90E-07	URF/Tier 1	
Biphenyl					1.83E-01 N	1.83E-01 N							PRG/Tier 2	f
bis(2-Ethylhexyl) Phthalate					4.80E-04 C	4.47E-04 C			7.00E-02	7.30E-02	2.40E-03	7.90E-04	PRG/Tier 2	g
Bromoform			1.10E-03	1.72E-03	1.75E-03 C	1.61E-03 C							URF/Tier 1	
1,3-Butadiene	2.00E-03	2.09E-03	3.00E-02	6.32E-05	6.11E-05 C	6.26E-05 C			2.00E-02	2.09E-02	1.70E-01	1.12E-05	URF/Tier 1	
Cadmium Compounds			1.80E+00	1.05E-06	1.07E-06 C	9.94E-07 C			2.00E-05	2.09E-05	4.20E+00	4.51E-07	URF/Tier 1	
Carbon Disulfide	7.00E-01	7.30E-01			7.30E-01 N	7.30E-01 N	9.33E-01	9.73E-01	8.00E-01	8.34E-01			RfC/Tier 1	
Carbon Tetrachloride			1.50E-02	1.26E-04	1.28E-04 C	1.18E-04 C	1.89E-01	1.97E-01	4.00E-02	4.17E-02	4.20E-02	4.51E-05	URF/Tier 1	h
Carbonyl Sulfide													no data available	i
2-Chloroacetophenone	3.00E-05	3.13E-05			3.13E-05 N				3.00E-05	3.13E-05			RfC/Tier 1	
Chlorobenzene					6.21E-02 N	6.21E-02 N			1.00E+00	1.04E+00			REL-CalEPA/Tier 3	j
Chloroform			2.30E-02	8.24E-05	8.30E-05 C	7.73E-05 C	9.76E-02	1.02E-01	3.00E-01	3.13E-01	5.30E-03	3.58E-04	URF-CalEPA/Tier 3	k
Chromium Compounds	8.00E-06	8.34E-06	1.20E+01	1.58E-07	1.60E-07 C	1.53E-07 C			2.00E-04	2.09E-04	1.50E+02	1.26E-08	URF/Tier 1	l
Cobalt Compounds					6.86E-07 C	6.39E-07 C	1.00E-04	1.04E-04					PRG/Tier 2	m
Cumene	4.00E-01	4.17E-01			4.02E-01 N	4.02E-01 N							RfC/Tier 1	
Cyanide Compounds	3.00E-03	3.13E-03			3.13E-03 N	3.14E-03 N			9.00E-03	9.39E-03			RfC/Tier 1	n
Dibenzofurans					7.30E-03 N	7.30E-03 N							PRG/Tier 2	o
1,4-Dichlorobenzene	8.00E-01	8.34E-01			3.06E-04 C	2.85E-04 C	1.20E-01	1.25E-01	8.00E-01	8.34E-01	1.10E-02	1.72E-04	PRG/Tier 2	p
Dichloromethane (Methylene Chloride)			4.70E-04	4.03E-03	4.09E-03 C	3.79E-03 C	1.04E+00	1.09E+00	4.00E-01	4.17E-01	1.00E-03	1.90E-03	URF/Tier 1	
N, N-Dimethylaniline					7.30E-03 N	7.30E-03 N							PRG/Tier 2	q
Dimethyl Formamide	3.00E-02	3.13E-02			3.13E-02 N				8.00E-02	8.34E-02			RfC/Tier 1	
Dimethyl Sulfate													no data available	r
2,4-Dinitrotoluene					7.30E-03 N	7.30E-03 N					8.90E-02	2.13E-05	URF-CalEPA/Tier 3	s
Ethyl Benzene	1.00E+00	1.04E+00			1.06E+00 N	1.06E+00 N			2.00E+00	2.09E+00			RfC/Tier 1	t
Ethyl Chloride (Chloroethane)	1.00E+01	1.04E+01			2.32E-03 C	2.16E-03 C			3.00E+01	3.13E+01			RfC/Tier 1	u
Ethylene Dibromide (Dibromoethane)	9.00E-03	9.39E-03	6.00E-01	3.16E-06	3.40E-06 C	3.13E-06 C			8.00E-04	8.34E-04	7.10E-02	2.67E-05	URF/Tier 1	
Ethylene Dichloride (1,2-Dichloroethane)			2.60E-02	7.29E-05	7.39E-05 C	6.88E-05 C	2.43E+00	2.53E+00	4.00E-01	4.17E-01	2.10E-02	9.03E-05	URF/Tier 1	

Table 1 - Arizona DEQ - Chronic Ambient Air Concentrations Table

Chemical	Tier 1 EPA RfC (mg/m^3)	Tier 1 EPA RfC Adjusted Health-Based Concentration[a] (mg/m^3)	Tier 1 EPA URF ($mg/m^3)^{-1}$	Tier 1 EPA URF Adjusted Health-Based Concentration[b] (mg/m^3)	Tier 2 EPA Regions Ambient Air PRG (mg/m^3)	Tier 2 EPA Regions Ambient Air RBC (mg/m^3)	Tier 3 ATSDR MRL (mg/m^3)	Tier 3 ATSDR MRL Adjusted Health-Based Concentration[a] (mg/m^3)	Tier 3 CalEPA REL (mg/m^3)	Tier 3 CalEPA REL Adjusted Health-Based Concentration[a] (mg/m^3)	Tier 3 CalEPA URF ($mg/m^3)^{-1}$	Tier 3 CalEPA URF Adjusted Health-Based Concentration[b] (mg/m^3)	Value to be Used	Notes
Ethylene Glycol					7.30E+00 N	7.30E+00 N			4.00E-01	4.17E-01			REL-CalEPA/Tier 3	v
Ethylidene Dichloride (1,1-Dichloroethane)					5.21E-01 N	5.11E-01 N					1.60E-03	1.19E-03	PRG/Tier 2	w
Formaldehyde			1.30E-02	1.46E-04	1.48E-04 C	1.39E-04 C	9.84E-03	1.03E-02	3.00E-03	3.13E-03	6.00E-03	3.16E-04	URF/Tier 1	
Glycol Ethers (Surrogate - Diethylene glycol, monoethyl ether)					3.14E-03 N	3.14E-03 N							PRG/Tier 2	x
Hexachlorobenzene			4.60E-01	4.12E-06	4.18E-06 C	3.91E-06 C			2.80E-03	2.92E-03	5.10E-01	3.72E-06	URF/Tier 1	
Hexane	2.00E-01	2.09E-01			2.09E-01 N	2.08E-01 N	2.12E+00	2.21E+00	7.00E+00	7.30E+00			MRL/Tier 3	y
Hydrochloric Acid	2.00E-02	2.09E-02			2.08E-02 N	2.08E-02 N			9.00E-03	9.39E-03			RfC/Tier 1	
Hydrogen Fluoride (Hydrofluoric Acid)									1.40E-02	1.46E-02			REL-CalEPA/Tier 3	
Isophorone					7.08E-03 C	6.59E-03 C			2.00E+00	2.09E+00			REL-CalEPA/Tier 3	z
Manganese Compounds	5.00E-05	5.21E-05			5.11E-05 N	5.22E-05 N	4.00E-05	4.17E-05	2.00E-04	2.09E-04			RfC/Tier 1	
Mercury Compounds	3.00E-04	3.13E-04			3.13E-04 N	3.14E-04 N	2.00E-04	2.09E-04	9.00E-05	9.39E-05			RfC/Tier 1	
Methanol					1.83E+00 N	1.83E+00 N			4.00E+00	4.17E+00			REL-CalEPA/Tier 3	aa
Methyl Bromide	5.00E-03	5.21E-03			5.21E-03 N	5.11E-03 N	1.95E-02	2.03E-02	5.00E-03	5.21E-03			RfC/Tier 1	bb
Methyl Chloride	9.00E-02	9.39E-02			9.49E-02 N	9.49E-02 N	1.04E-01	1.08E-01					RfC/Tier 1	
Methyl Ethyl Ketone	5.00E+00	5.21E+00			5.11E+00 N	5.11E+00 N			1.00E+00	1.04E+00			RfC/Tier 1	
Methyl Isobutyl Ketone (Hexone)	3.00E+00	3.13E+00			3.14E+00 N	3.14E+00 N							RfC/Tier 1	
Methyl Methacrylate	7.00E-01	7.30E-01			7.30E-01 N	7.30E-01 N			9.80E-01	1.02E+00			RfC/Tier 1	
Methyl Tert-Butyl Ether	3.00E+00	3.13E+00			7.40E-03 C	1.57E-03 C	2.50E+00	2.61E+00	8.00E-01	8.34E-01	2.60E-04	7.29E-03	PRG/Tier 2	cc
Methylhydrazine					3.96E-07 C								PRG/Tier 2	dd
Naphthalene	3.00E-03	3.13E-03			3.13E-03 N	3.29E-03 N	3.67E-03	3.83E-03	9.00E-03	9.39E-03	3.40E-02	5.58E-05	URF-CalEPA/Tier 3	ee
Nickel Compounds			2.40E-01	7.90E-06	8.00E-06 C	7.45E-06 C	9.00E-05	9.39E-05	5.00E-05	5.21E-05	2.60E-01	7.29E-06	URF/Tier 1	ff
Phenol					1.10E+00 N	1.10E+00 N			2.00E-01	2.09E-01			REL-CalEPA/Tier 3	gg
Polychlorinated Biphenyls			1.00E-01	1.90E-05	3.36E-06 C	3.13E-06 C			1.20E-03	1.25E-03	5.70E-01	3.33E-06	URF/Tier 1	hh
Polycyclic Organic Matter (Surrogate - Benzo(a)pyrene)					9.21E-07 C	2.0E-06 C					1.10E+00	1.72E-06	RBC/Tier 2	ii
Propionaldehyde (Surrogate - Acetaldehyde)	9.00E-03	9.39E-03	2.20E-03	8.62E-04	8.73E-04 C	8.13E-04 C							URF/Tier 1	jj
Propylene Dichloride	4.00E-03	4.17E-03			9.89E-05 C	9.21E-05 C							RfC/Tier 1	kk
Selenium Compounds						1.83E-02 N			2.00E-02	2.09E-02			RBC/Tier 2	ll
Styrene	1.00E+00	1.04E+00			1.06E+00 N	1.04E+00 N	2.56E-01	2.67E-01	9.00E-01	9.39E-01			RfC/Tier 1	
1,1,2,2-Tetrachloroethane			5.80E-02	3.27E-05	3.31E-05 C	3.13E-05 C					5.80E-02	3.27E-05	URF/Tier 1	
Tetrachloroethylene (Perchlorethylene)					3.20E-04 C	3.13E-04 C	2.71E-01	2.83E-01	3.50E-02	3.65E-02	5.90E-03	3.21E-04	PRG/Tier 2	mm
Toluene	4.00E-01	4.17E-01			4.02E-01 N	4.16E-01 N	3.02E-01	3.15E-01	3.00E-01	3.13E-01			RfC/Tier 1	
1,1,1-Trichloroethane (Methyl Chloroform)					2.30E+00 N	2.30E+00 N			1.00E+00	1.04E+00			PRG/Tier 2	nn
Trichloroethylene					1.68E-05 C	1.57E-05 C			6.00E-01	6.26E-01	2.00E-03	9.48E-04	PRG/Tier 2	oo

Table 1 - Arizona DEQ - Chronic Ambient Air Concentrations Table

Chemical	Tier 1				Tier 2		Tier 3						Value to be Used	Notes
	EPA				EPA Regions		ATSDR		CalEPA					
	RfC (mg/m^3)	RfC Adjusted Health-Based Concentration[a] (mg/m^3)	URF $(mg/m^3)^{-1}$	URF Adjusted Health-Based Concentration[b] (mg/m^3)	Ambient Air PRG (mg/m^3)	Ambient Air RBC (mg/m^3)	MRL (mg/m^3)	MRL Adjusted Health-Based Concentration[a] (mg/m^3)	REL (mg/m^3)	REL Adjusted Health-Based Concentration[a] (mg/m^3)	URF $(mg/m^3)^{-1}$	URF Adjusted Health-Based Concentration[b] (mg/m^3)		
2,2,4-Trimethylpentane													no data available	[pp]
Vinyl Acetate	2.00E-01	2.09E-01			2.09E-01 N	2.08E-01 N			2.00E-01	2.09E-01			RfC/Tier 1	
Vinyl Chloride	1.00E-01	1.04E-01	8.80E-03	2.15E-04	1.06E-04 C	7.20E-05 C			2.60E-02	2.71E-02	7.80E-02	2.43E-05	URF/Tier 1	[qq]
Vinylidene Chloride (1,1-Dichloroethylene)	2.00E-01	2.09E-01			2.08E-01 N	2.19E-01 N			7.00E-02	7.30E-02			RfC/Tier 1	
Xylene (Mixed Isomers)	1.00E-01	1.04E-01			1.06E-01 N	1.10E-01 N	4.34E-01	4.53E-01	7.00E-01	7.30E-01			RfC/Tier 1	

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All PRGs and RBCs are based on inhalation toxicity criteria from IRIS, unless noted otherwise.
C = cancer based where target risk is 1E-06.
N = noncancer based where target hazard quotient is 1.0.
[a] Calculated based on the following equation: THQ x (RfC x IR/BW) x BW x ATn/(EF x ED x IR) where: THQ = 1, IR = 20 m^3/day, BW = 70 kg, ATn = 10,950 days, EF = 350 days/year, ED = 30 years
[b] Calculated based on the following equation: TR x ATc/(EF x IFA_{adj} x [URF x BW/IR]) where: TR = 1E-06, ATc = 25,550 days, EF = 350 days/year, IFA_{adj} = 11 m^3-year/kg-day, BW = 70 kg, IR = 20 m^3/day
[c] The RBC is based on an oral RfD from IRIS from a 1967 oral study on rats that showed general toxicity.
[d] The RBC is based on an oral RfD from IRIS from a 1970 oral study in rats that showed longevity, blood glucose, and cholesterol effects.
[e] The PRG and RBC are based on an oral CSF from IRIS from a 1986 rat gavage, corn oil study. The following types of cancer were observed: thyroid (females), stomach (males and females), lung (females), hemangiosarcoma (males), and hepatic carcinoma (males).
[f] The PRG and RBC are based on an oral RfD from IRIS from a 1960 study that showed kidney damage.
[g] The PRG and RBC are based on oral CSF from IRIS from a 1982 oral study in mice and rats that showed an increased incidence of liver tumors. The Cal EPA URF is extrapolated from the same study.
[h] Currently undergoing EPA review, new values are expected to be determined by early 2006.
[i] There is no quantitative data available and no obvious surrogates.
[j] The PRG and RBC are based on an inhalation RfD from a 1989 NCEA document. The CalEPA REL is based on a 2000 review of a 1987 rat inhalation study that showed an increase in liver weights and kidney and testicular effects. Because the CalEPA is based on a more recent review of the available data, it was selected.
[k] EPA is currently in the process of revising the inhalation assessment for chloroform (Agency review to be completed by 12/30/05). The current EPA URF was developed in 1987 and is based on data from a 1976 gavage study that does not incorporate newer data. The CalEPA URF was developed in 1990 and is based on data from studies from 1976 through 1985, two of which are gavage studies and one that is a drinking water study. The CalEPA URF was selected because it is a more recent evaluation on chloroform carcinogenicity that incorporates some pharmacokinetics.
[l] The RfC is based on chromic acid mists and dissolved hexavalent chromium (Cr VI) aerosols. The EPA URF and RBC are based on Cr VI. The PRG is based on total Cr assuming a 1:6 ratio of Cr VI to Cr III.
[m] The PRG and RBC are based on an inhalation CSF from PPRTV.
[n] Based on hydrogen cyanide.
[o] The PRG and RBC are based on an oral RfD from NCEA.
[p] The RfC is derived from an inhalation rat reproductive study from 1986. The PRG and RBC are based on a more recent inhalation CSF from NCEA. The PRG was selected.
[q] The PRG and RBC are based on an oral RfD from IRIS from a 1984 gavage study on mice that showed spleen effects.
[r] EPA classifies dimethyl sulfate as a B2 carcinogen. However, there is no quantitative data available and no obvious surrogates.
[s] The PRG and RBC are based on an oral RfD from IRIS from a 1985 dog feeding study that showed neurotoxicity and Heinz bodies and bilary tract hyperplasia. The CalEPA URF is based on an EPA derived cancer potency value from 1980 that is based on a 1978 oral feeding study on rats. Because neither criteria is clearly based on better data than the other, the more conservative CalEPA URF was selected.
[t] EPA is currently in the process of revising the assessment of ethylbenzene (Review to be completed in early 2006). The toxicity values may become significantly more restrictive at that time based on an NTP study that indicates carcinogenicity in animals.
[u] The RfC and CalEPA REL are based on the same 1986 mouse inhalation study. The difference between the values is due to the uncertainty factors used. The RfC is based on an uncertainty factor of 300. The REL is based on an uncertainty factor of 30. The PRG and RBC are based on an oral CSF from NCEA (uterine and liver cancer). EPA is in the process of reviewing the ethyl chloride assessment, the second draft is expected to be completed in October 2005 with a new assessment posted towards the end of 2006. The RfC was selected.

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[v] The PRG and RBC are based on an oral RfD from IRIS that is from a 1986 chronic feeding study on rats that showed kidney toxicity. The CalEPA REL is from a 2000 review of a 1974 subchronic inhalation study on human volunteers that showed respiratory tract irritation. CalEPA REL was selected because it is based on a human inhalation study.
[w] The PRG and RBC are based on an RfC from HEAST (inhalation study). EPA classified ethylidene dichloride as a possible human carcinogen (Category -C). However, CalEPA has developed a URF. It is EPA policy not to develop cancer based criteria for category C carcinogens. Thus, the PRG was selected.
[x] The PRG and RBC are based on the compound (diethylene glycol, monoethyl ether) with the most stringent toxicological criteria.
[y] The RfC and MRL are both based on a 1980 epidemiological inhalation study. The difference between the values is due to the uncertainty factors used. The RfC, developed in 1993, is based on an uncertainty factor of 300. The MRL, developed in 1999, is based on an uncertainty factor of 100. The CalEPA REL is based on 2000 review of a 1967 animal inhalation study. The MRL was selected because it is based on a more recent review of the available data, whereas the RfC is based on a review that is over 10 years old.
[z] The PRG and RBC are based on an oral CSF from IRIS from a 1986 gavage study that showed an increased incidence in preputial gland tumors in male rats. The CalEPA REL is from two 1984 inhalation studies on mice and rats that showed developmental effects and teratogenicity. The CalEPA REL was selected because it is based on an inhalation studies.
[aa] The PRG and RBC are based on a 1993 oral RfD from IRIS (critical effect: increased SGPT and SAP). The CalEPA REL is based on 2000 review of a 1993 inhalation study that showed development effects in offspring of pregnant mice. The CalEPA REL was selected because it is based on an inhalation study.
[bb] The RfC is from 1992 and is based on two rat inhalation studies from 1987 and 1991. The MRL is based on 1992 review of a 1986 occupational study . The RfC was selected because it is based on more recent studies than the MRL.
[cc] The PRG is based on an inhalation CSF from CalEPA. The RBC is based on an oral CSF from "Other" source (type of cancer unknown). The PRG was selected because it is based on an inhalation CSF from CalEPA.
[dd] The PRG is based on an inhalation CSF from NCEA.
[ee] Subject to change per IRIS tracking database; estimated date. The CalEPA URF is based on nasal respiratory epithelial adenoma and nasal olfactory epithelial neuroblastoma in male rats. EPA documents indicate that naphthalene will be classified as a carcinogen, therefore, the CalEPA URF was selected as the most relevant criteria.
[ff] Based on nickel refinery dust.
[gg] The PRG and RBC are based on an oral RfD from IRIS from a 1997 study that showed decreased maternal weight gain in rats. The CalEPA REL is based on a 2000 review of 1961 and 1974 inhalation studies on mice, rats and monkeys that showed systemic effects. The CalEPA REL was selected because it is based on inhalation studies.
[hh] The PRG and RBC are based on Aroclor 1254 inhalation CSF that is derived from an oral study.
[ii] Benzo(a)pyrene value used. The PRG is based on an oral CSF from IRIS. The RBC is based on an inhalation CSF from NCEA. Because the RBC is based on an inhalation value, it was selected.
[jj] The toxicity of propionaldehyde is currently being evaluated by EPA with finalization expected in November 2006. For the present, acetaldehyde was used as a surrogate compound.
[kk] The RfC is from a rat inhalation study from 1988. The PRG and RBC are based on an oral CSF from HEAST that showed liver tumors. The RfC was selected because it is based on an inhalation study.
[ll] The RBC is based on an oral RfD from IRIS from a 1989 epidemiological study that showed clinical selenosis. The CalEPA inhalation REL is extrapolated from a chronic oral REL, which is the same as the EPA's oral RfD. While the values are essentially the same, the RBC was selected under Tier 2.
[mm] The PRG is based on an inhalation CSF from CalEPA. The RBC is based on an inhalation CSF from "Other" source (likely CalEPA given the similarity in the PRG and RBC). The PRG was selected because it is based on an inhalation CSF from CalEPA.
[nn] The PRG and RBC are based on an RfC from PPRTV.

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[oo] The PRG and RBC are based on an inhalation CSF from NCEA. EPA is in the process of reviewing the trichloroethylene assessment, the second draft is expected to be completed in January 2006. The CalEPA URF is based on studies performed between 1978 and 1986. The PRG was selected.
[pp] Currently undergoing EPA review, values expected to be determined by mid 2006.
[qq] The URF, PRG, and RBC are based on continuous lifetime exposure from birth.

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Chemical	Conversion Factor[a] mg/m^3 to ppm
Acetaldehyde	1 ppm = 1.80 mg/m^3
Acetophenone	1 ppm = 4.91 mg/m^3
Acrolein	1 ppm = 2.29 mg/m^3
Acrylonitrile	1 ppm = 2.17 mg/m^3
Antimony Compounds	1 ppm = 4.98 mg/m^3
Arsenic Compounds	1 ppm = 8.09 mg/m^3
Benzene	1 ppm = 3.19 mg/m^3
Benzyl Chloride	1 ppm = 5.18 mg/m^3
Beryllium Compounds	1 ppm = 0.37 mg/m^3
Biphenyl	1 ppm = 6.31 mg/m^3
bis(2-Ethylhexyl) Phthalate	1 ppm = 15.97 mg/m^3
Bromoform	1 ppm = 10.34 mg/m^3
1,3-Butadiene	1 ppm = 2.21 mg/m^3
Cadmium Compounds	1 ppm = 4.59 mg/m^3
Carbon Disulfide	1 ppm = 3.11 mg/m^3
Carbon Tetrachloride	1 ppm = 6.29 mg/m^3
Carbonyl Sulfide	1 ppm = 2.46 mg/m^3
2-Chloroacetophenone	1 ppm = 6.32 mg/m^3
Chlorobenzene	1 ppm = 4.61 mg/m^3
Chloroform	1 ppm = 4.88 mg/m^3
Chromium Compounds	1 ppm = 4.82 mg/m^3 [b]
Cobalt Compounds	1 ppm = 2.41 mg/m^3
Cumene	1 ppm = 4.92 mg/m^3
Cyanide Compounds	1 ppm = 1.10 mg/m^3 [c]
Dibenzofurans	1 ppm = 6.88 mg/m^3
1,4-Dichlorobenzene	1 ppm = 6.01 mg/m^3
Dichloromethane (Methylene Chloride)	1 ppm = 3.47 mg/m^3
N, N-Dimethylaniline	1 ppm = 4.96 mg/m^3
Dimethyl Formamide	1 ppm = 2.99 mg/m^3
Dimethyl Sulfate	1 ppm = 5.16 mg/m^3
2,4-Dinitrotoluene	1 ppm = 7.45 mg/m^3
Ethyl Benzene	1 ppm = 4.34 mg/m^3
Ethyl Chloride (Chloroethane)	1 ppm = 2.64 mg/m^3
Ethylene Dibromide (Dibromoethane)	1 ppm = 7.69 mg/m^3
Ethylene Dichloride (1,2-Dichloroethane)	1 ppm = 4.05 mg/m^3
Ethylene Glycol	1 ppm = 2.54 mg/m^3
Ethylidene Dichloride (1,1-Dichloroethane)	1 ppm = 4.05 mg/m^3
Formaldehyde	1 ppm = 1.23 mg/m^3

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Chemical	Conversion Factor[a] mg/m^3 to ppm
Glycol Ethers (Surrogate - Diethylene glycol, monoethyl ether)	1 ppm = 5.49 mg/m^3
Hexachlorobenzene	1 ppm = 11.65 mg/m^3
Hexane	1 ppm = 3.53 mg/m^3
Hydrochloric Acid	1 ppm = 1.49 mg/m^3
Hydrogen Fluoride (Hydrofluoric Acid)	1 ppm = 0.82 mg/m^3
Isophorone	1 ppm = 5.65 mg/m^3
Manganese Compounds	1 ppm = 2.25 mg/m^3
Mercury Compounds	1 ppm = 8.20 mg/m^3
Methanol	1 ppm = 1.31 mg/m^3
Methyl Bromide	1 ppm = 3.89 mg/m^3
Methyl Chloride	1 ppm = 2.07 mg/m^3
Methyl Ethyl Ketone	1 ppm = 2.95 mg/m^3
Methyl Isobutyl Ketone (Hexone)	1 ppm = 4.10 mg/m^3
Methyl Methacrylate	1 ppm = 4.09 mg/m^3
Methyl Tert-Butyl Ether	1 ppm = 3.61 mg/m^3
Methylhydrazine	1 ppm = 1.89 mg/m^3
Naphthalene	1 ppm = 5.24 mg/m^3
Nickel Compounds	1 ppm = 2.40 mg/m^3
Phenol	1 ppm = 3.85 mg/m^3
Polychlorinated Biphenyls	1 ppm = 13.37 mg/m^3 [d]
Polycyclic Organic Matter (Surrogate - Benzo(a)pyrene)	1 ppm = 10.32 mg/m^3
Propionaldehyde (Surrogate - Acetaldehyde)	1 ppm = 1.80 mg/m^3
Propylene Dichloride	1 ppm = 4.62 mg/m^3
Selenium Compounds	1 ppm = 3.23 mg/m^3
Styrene	1 ppm = 4.26 mg/m^3
1,1,2,2-Tetrachloroethane	1 ppm = 6.87 mg/m^3
Tetrachloroethylene (Perchlorethylene)	1 ppm = 6.78 mg/m^3
Toluene	1 ppm = 3.77 mg/m^3
1,1,1-Trichloroethane (Methyl Chloroform)	1 ppm = 5.46 mg/m^3
Trichloroethylene	1 ppm = 5.37 mg/m^3
2,2,4-Trimethylpentane	1 ppm = 4.67 mg/m^3
Vinyl Acetate	1 ppm = 3.52 mg/m^3
Vinyl Chloride	1 ppm = 2.56 mg/m^3
Vinylidene Chloride (1,1-Dichloroethylene)	1 ppm = 3.96 mg/m^3
Xylene (Mixed Isomers)	1 ppm = 4.34 mg/m^3

NA = not applicable

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Chemical	Conversion Factor[a] mg/m^3 to ppm

[a] Conversion for gases and vapors from mg/m^3 to parts per million (ppm) is performed using the following equation:

$$ppm = \frac{mg/m^3 \times 24.45}{MW}$$

MW = molecular weight in grams

For example:

Acetaldehyde value = 8.62E-04 mg/m^3 and 1 ppm = 1.80 mg/m^3.

Therefore, 8.62E-04/1.80 = 4.79E-04 ppm.

[b] Based on Chromic (VI) acid.

[c] Based on hydrogen cyanide.

[d] Based on Aroclor 1254.